

## C4545 Log Data Report

### Borehole Information:

<b>Borehole:</b> C4545		<b>Site:</b> 216-A-8 Crib			
<b>Coordinates (WA St Plane)</b>		<b>GWL<sup>1</sup> (ft):</b> 261.15		<b>GWL Date:</b> 07/05/05	
<b>North</b>	<b>East</b>	<b>Drill Date</b>	<b>Ground Level Elevation</b>	<b>Total Depth (ft)</b>	<b>Type</b>
Not available	Not available	07/05	Not available	265	Cable

### Casing Information:

<b>Casing Type</b>	<b>Stickup (ft)</b>	<b>Outer Diameter (in.)</b>	<b>Inside Diameter (in.)</b>	<b>Thickness (in.)</b>	<b>Top (ft)</b>	<b>Bottom (ft)</b>
Threaded steel	0.8	10 7/8	9 11/16	19/32	+ 0.8	70
Threaded Steel	0.65	8 11/16	7 11/16	1/2	+ 0.65	265

### Borehole Notes:

The logging engineer measured the casing diameters using a caliper and steel tape. Ground level elevation was not available. The driller provided the casing depth. Logging data acquisition is referenced to the ground surface.

This borehole was logged in two stages, from the ground surface to 68 ft during June, and from 68 ft to total depth in July, so that log data were acquired in a single casing configuration.

### Spectral Gamma Logging System (SGLS) Equipment Information:

<b>Logging System:</b> Gamma 1E		<b>Type:</b> SGLS (70%) SN: 34TP40587A
<b>Effective Calibration Date:</b> 03/04/05	<b>Calibration Reference:</b> DOE-EM/GJ864-2005	
		<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0

### High Rate Logging System (HRLS) Equipment Information:

<b>Logging System:</b> Gamma 1C		<b>Type:</b> HRLS SN: 39-A314
<b>Effective Calibration Date:</b> 04/06/05	<b>Calibration Reference:</b> DOE-EM/GJ865-2005	
		<b>Logging Procedure:</b> MAC-HGLP 1.6.5, Rev. 0

**Spectral Gamma Logging System (SGLS) Log Run Information:**

Log Run	1	2	3	4 Repeat	11
Date	06/21/05	06/21/05	06/21/05	06/21/05	07/05/05
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	16.0	24.0	59.0	68.0
Finish Depth (ft)	17.0	25.0	69.0	68.0	260.0
Count Time (sec)	100	20	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A <sup>2</sup>	N/A	N/A	N/A	N/A
Pre-Verification	AE076CAB	AE076CAB	AE076CAB	AE076CAB	AE079CAB
Start File	AE076000	AE076018	AE076028	AE076074	AE079000
Finish File	AE076017	AE076027	AE076073	AE076083	AE079192
Post-Verification	AE076CAA	AE076CAA	AE076CAA	AE076CAA	AE079CAA
Depth Return Error (in.)	N/A	N/A	N/A	-1	- 2
Comments	No fine-gain adjustment	High rate interval; dead time > 40%	No fine-gain adjustment	No fine-gain adjustment	Fine-gain adjustment after files -072 and -083

Log Run	12 Repeat				
Date	07/06/05				
Logging Engineer	Spatz				
Start Depth (ft)	68.0				
Finish Depth (ft)	88.0				
Count Time (sec)	100				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	AE080CAB				
Start File	AE080000				
Finish File	AE080020				
Post-Verification	AE080CAA				
Depth Return Error (in.)	0				
Comments	No fine-gain adjustment				

**High Rate Logging System (HRLS) Log Run Information:**

Log Run	5	6	7	8 Repeat	9
Date	06/22/05	06/22/05	06/22/05	006/22/05	006/22/05
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	12.0	13.0	23.0	18.0	18.0
Finish Depth (ft)	14.0	24.0	25.0	21.0	22.0
Count Time (sec)	300	100	300	100	300
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	Y (internal)
MSA Interval (ft)	1.0	1.0	1.0	1.0	0.5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	AC133CAB	AC133CAB	AC133CAB	AC133CAB	AC133CAB
Start File	AC133000	AC133003	AC133015	AC133018	AC133022
Finish File	AC133002	AC133014	AC133017	AC133021	AC133030
Post-Verification	AC133CAA	AC133CAA	AC133CAA	AC133CAA	AC133CAA

Log Run	5	6	7	8 Repeat	9
Depth Return Error (in.)	N/A	N/A	N/A	N/A	N/A
Comments	Fine gain adjustment after file -03	Fine gain adjustment after file -05	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment

Log Run	10				
Date	06/22/05				
Logging Engineer	Spatz				
Start Depth (ft)	19.5				
Finish Depth (ft)	21.0				
Count Time (sec)	300				
Live/Real	R				
Shield (Y/N)	Y (internal)				
MSA Interval (ft)	0.5				
ft/min	N/A				
Pre-Verification	AC133CAB				
Start File	AC133031				
Finish File	AC133034				
Post-Verification	AC133CAA				
Depth Return Error (in.)	0				
Comments	No fine gain adjustment				

### **Logging Operation Notes:**

Logging was conducted with a centralizer on each sonde. Measurements are referenced to ground surface. Maximum logging depth was 260 ft, approximately 1 ft above groundwater. Repeat sections were collected in this borehole for all systems to evaluate the logging systems' performance.

### **Analysis Notes:**

<b>Analyst:</b>	Henwood	<b>Date:</b>	01/20/05	<b>Reference:</b>	GJO-HGLP 1.6.3, Rev. 0
-----------------	---------	--------------	----------	-------------------	------------------------

Pre-run and post-run verifications for the logging systems were performed before and after data acquisition. Acceptance criteria were met for all systems.

A casing correction for 19/32-in.-thick casing (10-in. casing) was applied to the spectral log data (SGLS and HRLS) from 0 to 68 ft. From 70 to 260 ft, a correction for 1/2-in. thick casing (8-in. casing) was applied to the SGLS data.

SGLS and HRLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1Emar05.xls for the SGLS and G1Capr05.xls for the HRLS using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed approximately 11 percent for both the SGLS and HRLS. Where SGLS dead time exceeds 40 percent, HRLS data are substituted. No correction for water was necessary.

### **Log Plot Notes:**

Separate log plots are provided for the man-made radionuclide (<sup>137</sup>Cs) detected in the borehole, naturally occurring radionuclides (<sup>40</sup>K, <sup>238</sup>U, <sup>232</sup>Th [KUT]), a combination of man-made, KUT, and total gamma plotted with dead time. For each radionuclide, the energy value of the spectral peak used for quantification

is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. Repeat log sections are also included where appropriate.

### **Results and Interpretations:**

<sup>137</sup>Cs was detected in this borehole between the ground surface and 5 ft and from 11 to 73 ft. The maximum concentration was measured at approximately 1.5 million pCi/g at 20 ft in depth. The highest concentration zone lies between 11 and 25 ft. <sup>137</sup>Cs contamination observed at relatively low concentrations (e.g., below 10 pCi/g) between 40 and 73 ft and <sup>137</sup>Cs spikes at probable casing joints at 50 and 60 ft, may be the result of casing contamination.

The repeat sections for the SGLS and HRLS indicate good agreement.

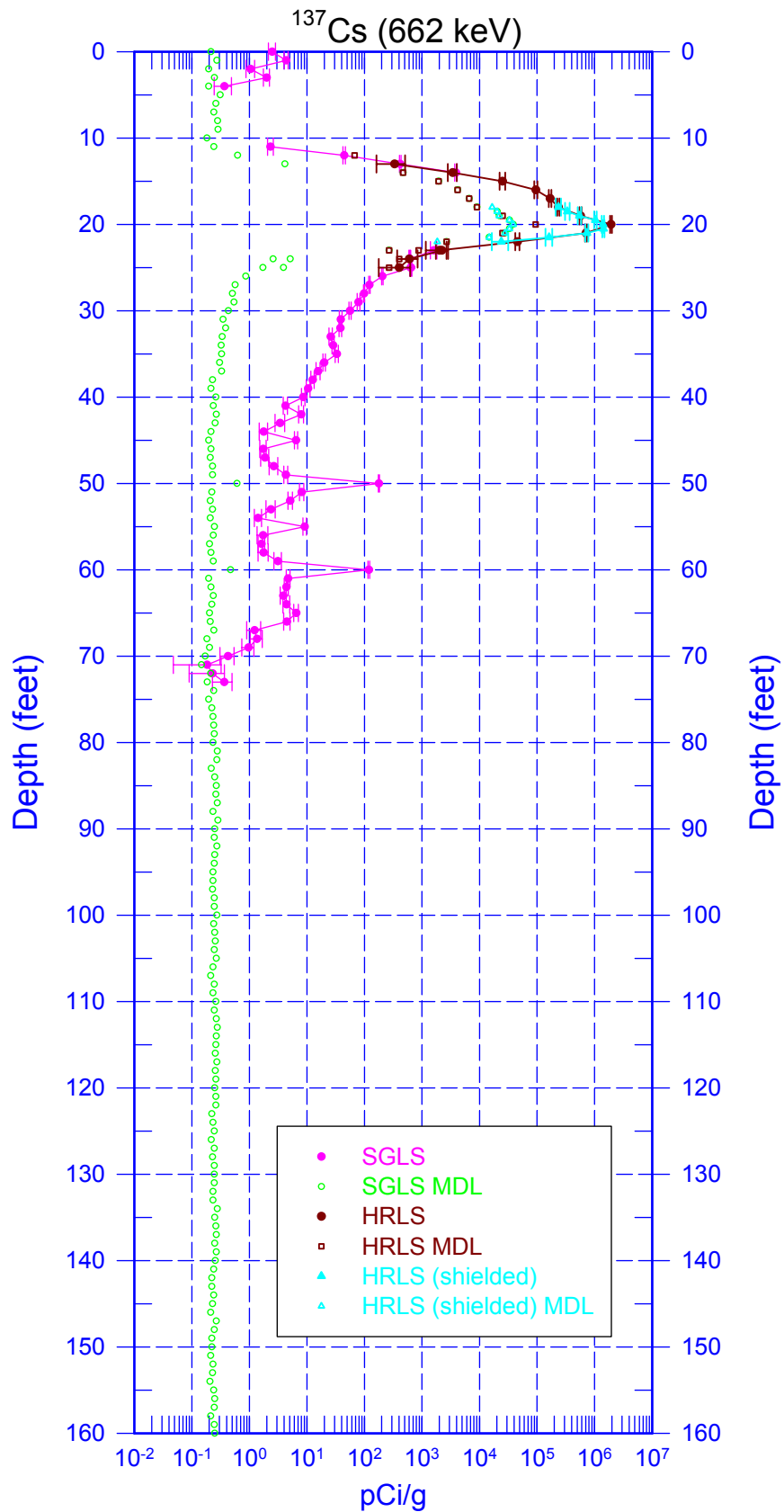
---

<sup>1</sup> GWL – groundwater level

<sup>2</sup> N/A – not applicable

# C4545

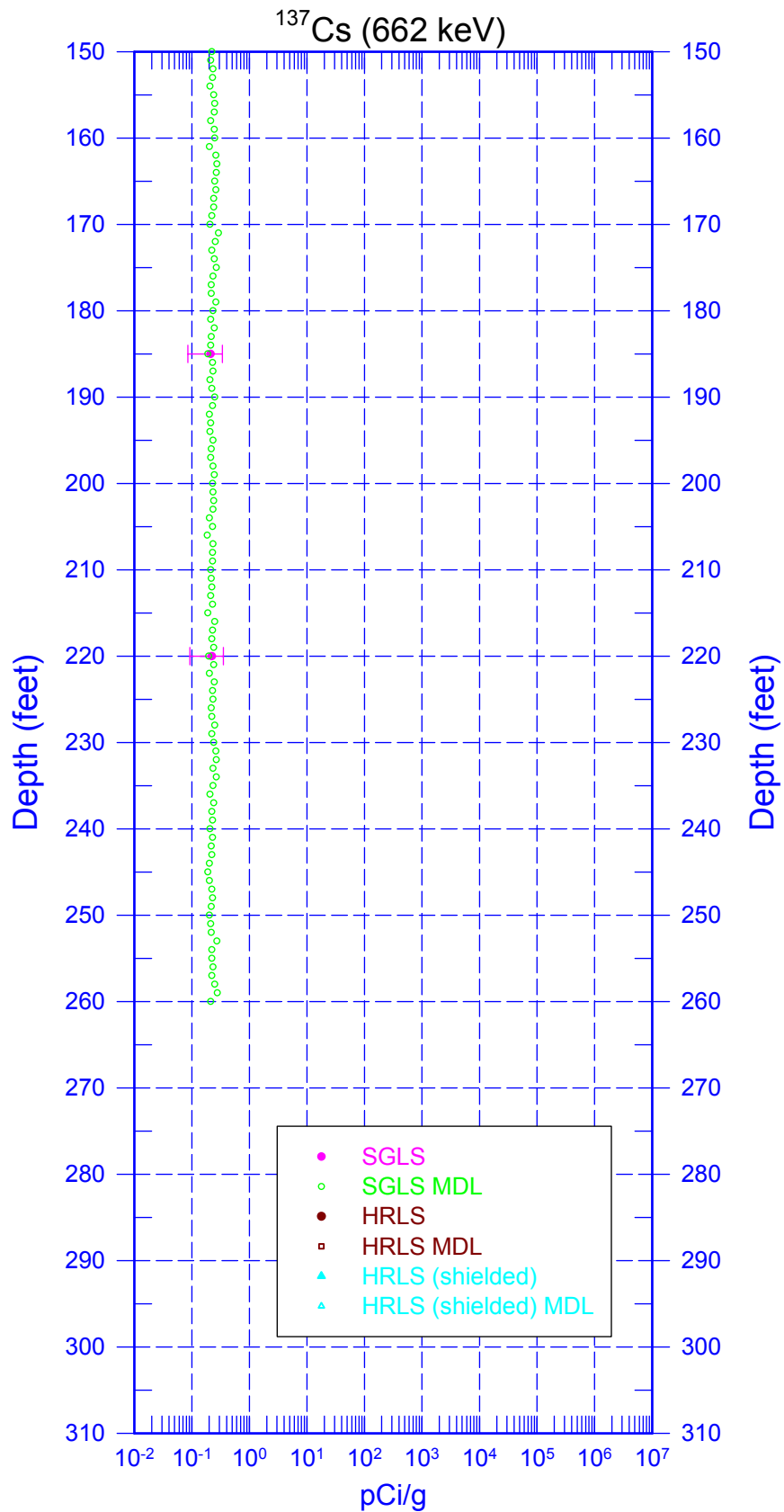
## Man-Made Radionuclides



Zero Reference = Ground surface

# C4545

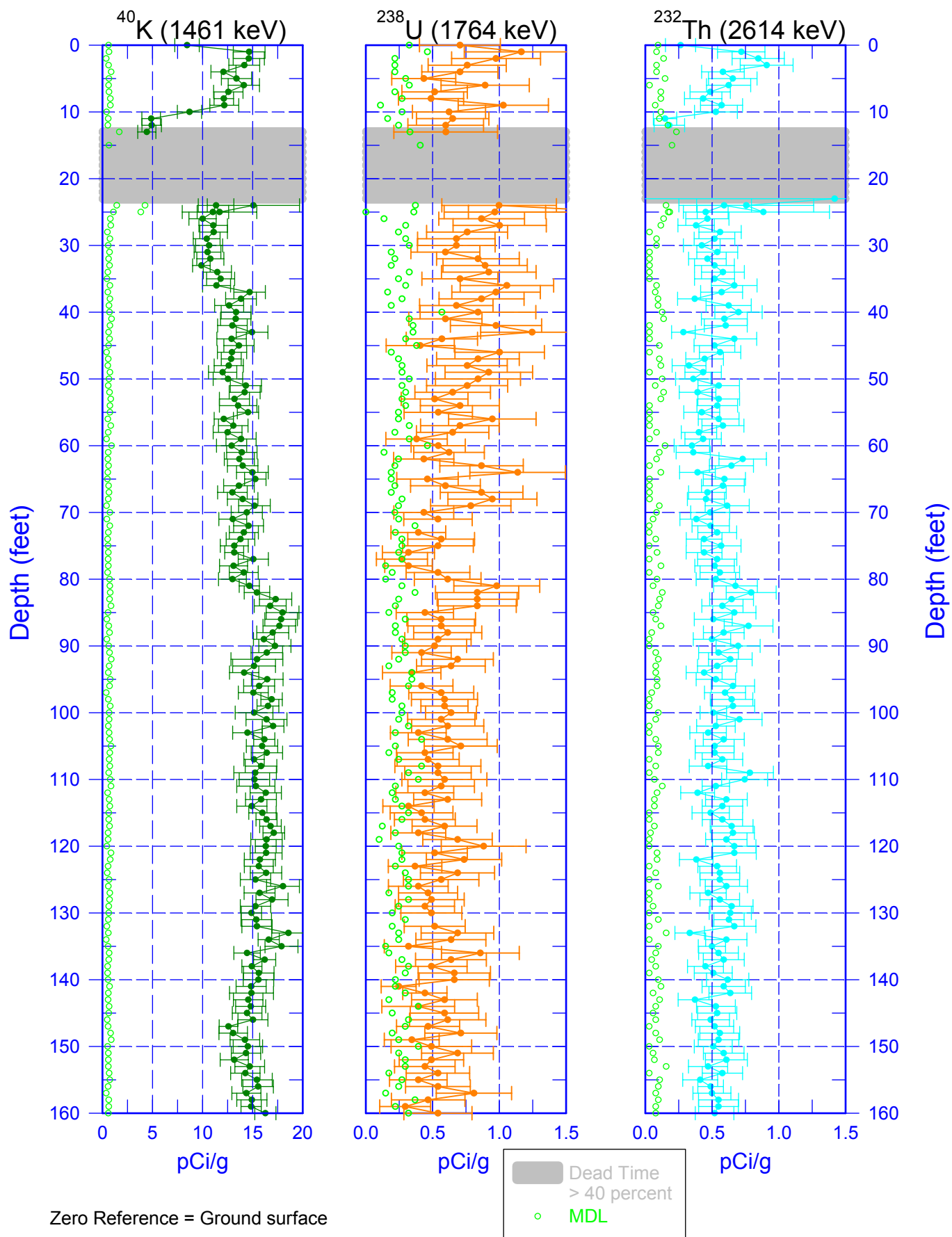
## Man-Made Radionuclides



Zero Reference = Ground surface

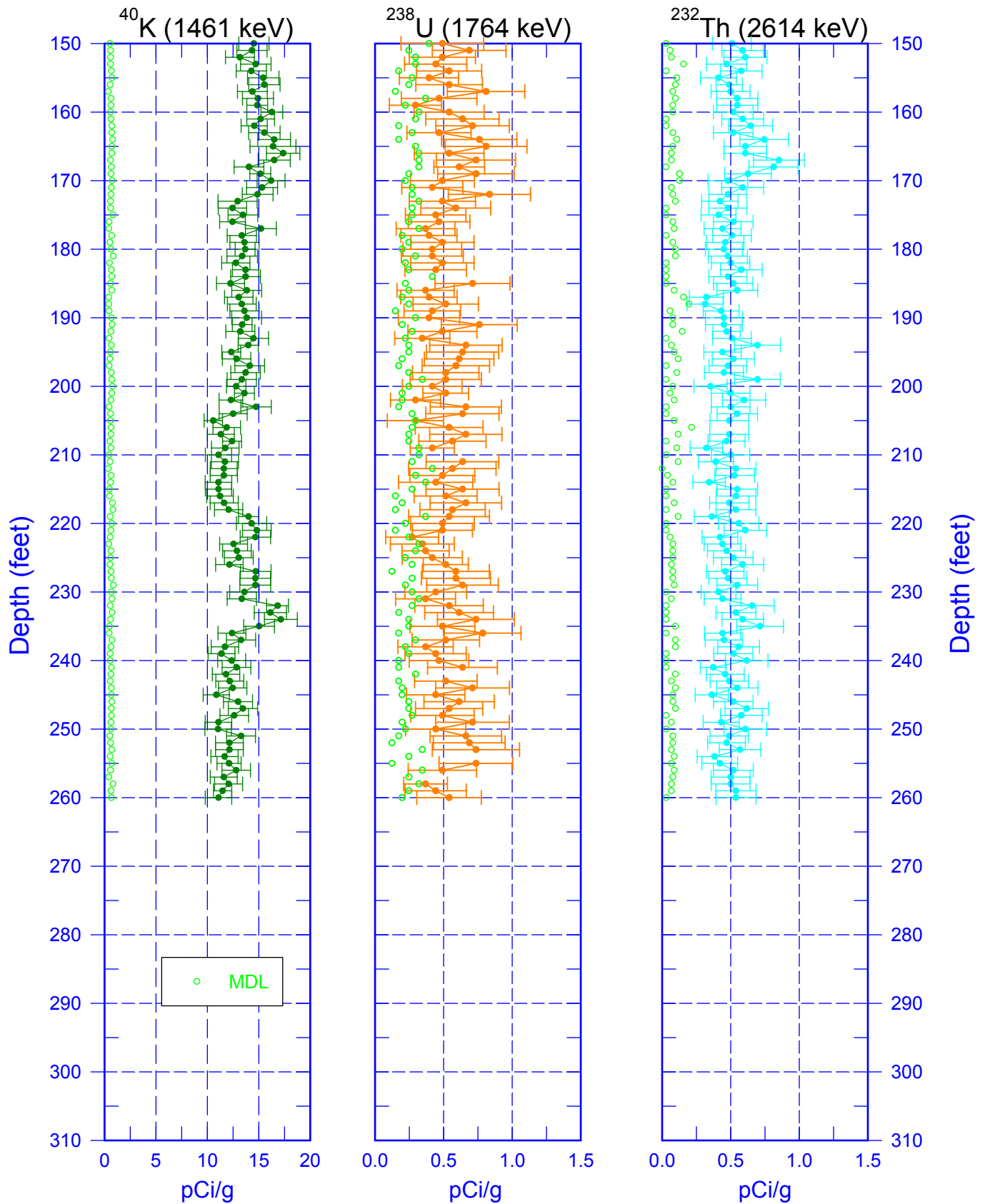
# C4545

## Natural Gamma Logs



# C4545

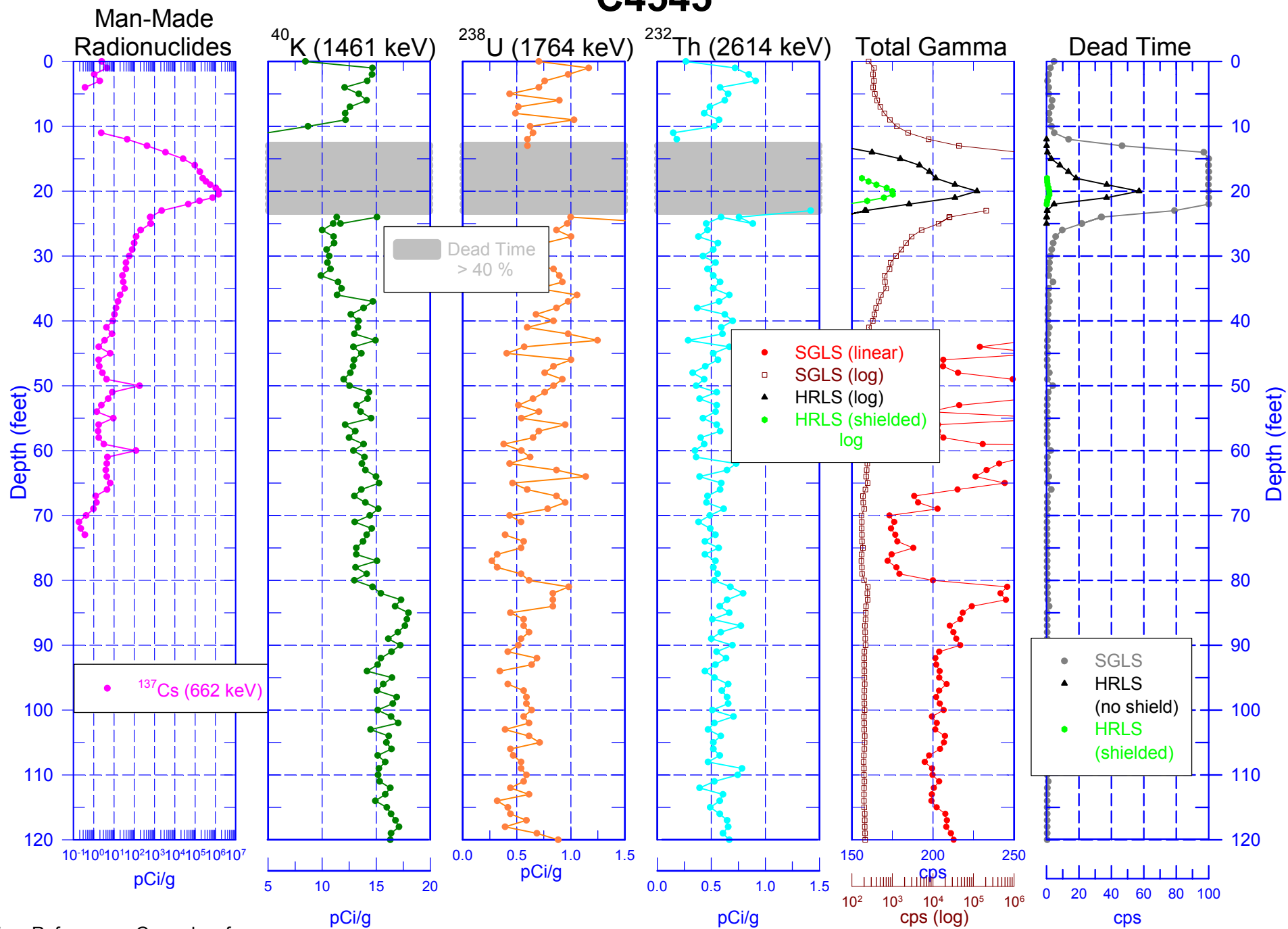
## Natural Gamma Logs



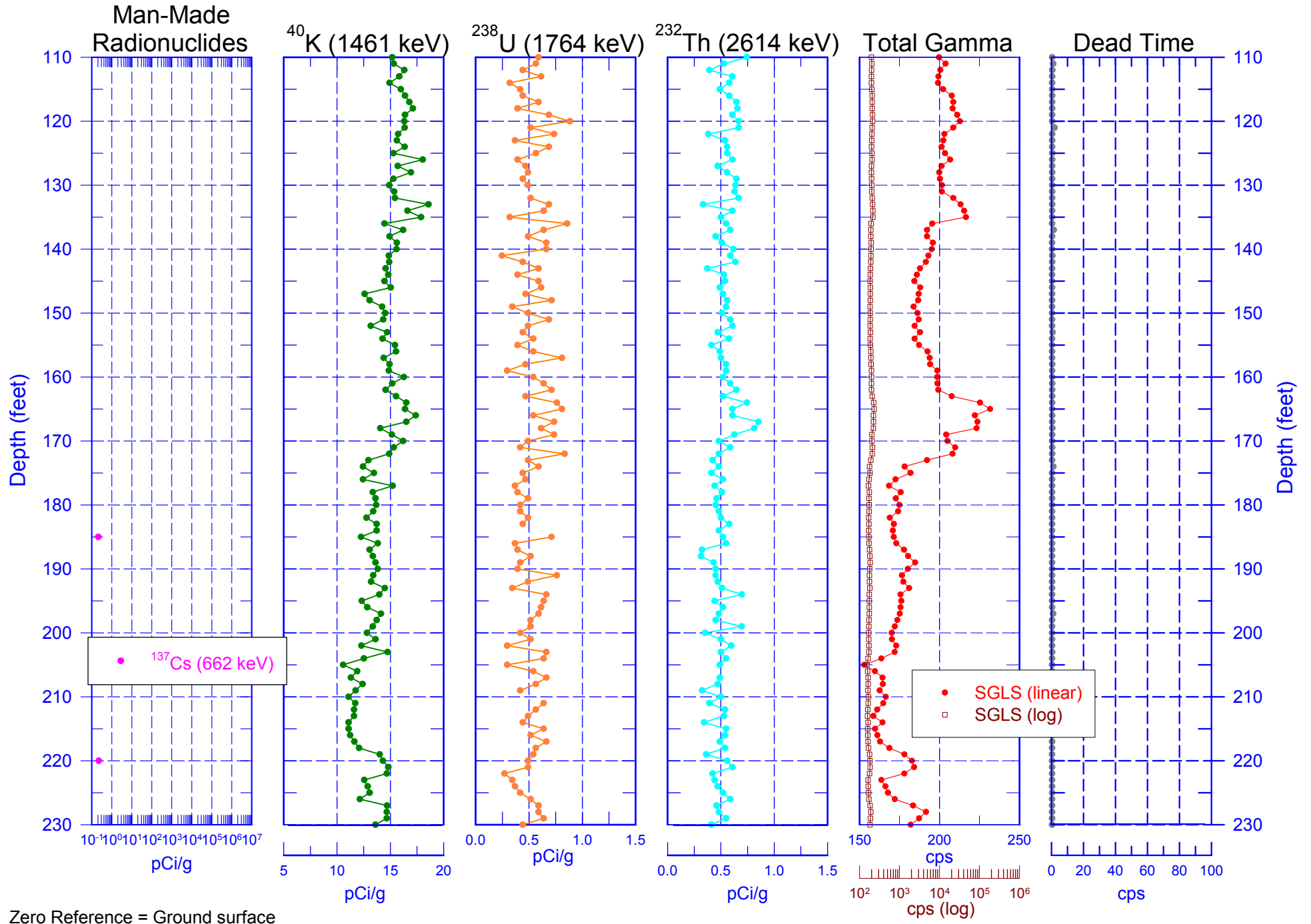
Zero Reference = Ground surface



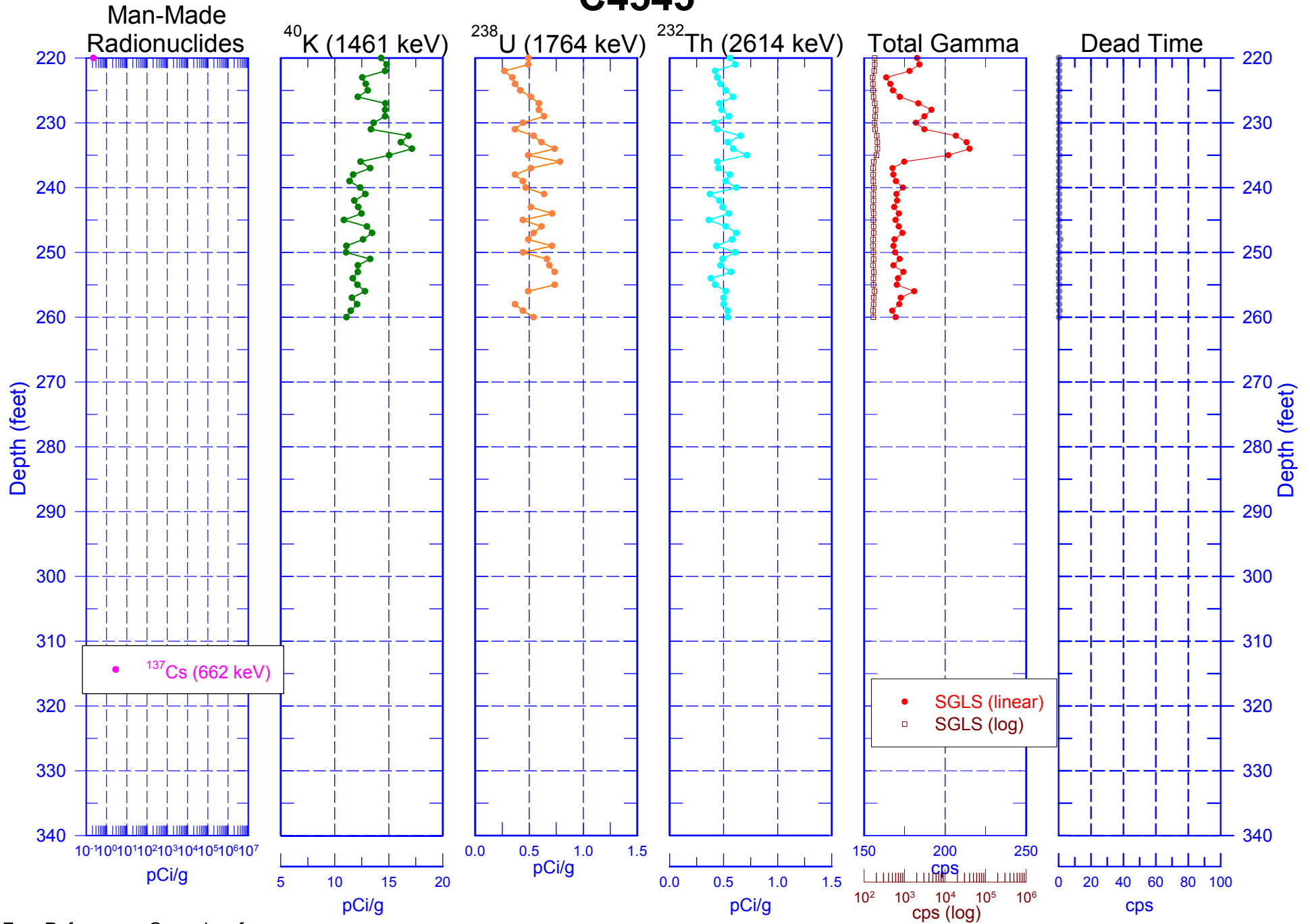
# C4545



# C4545

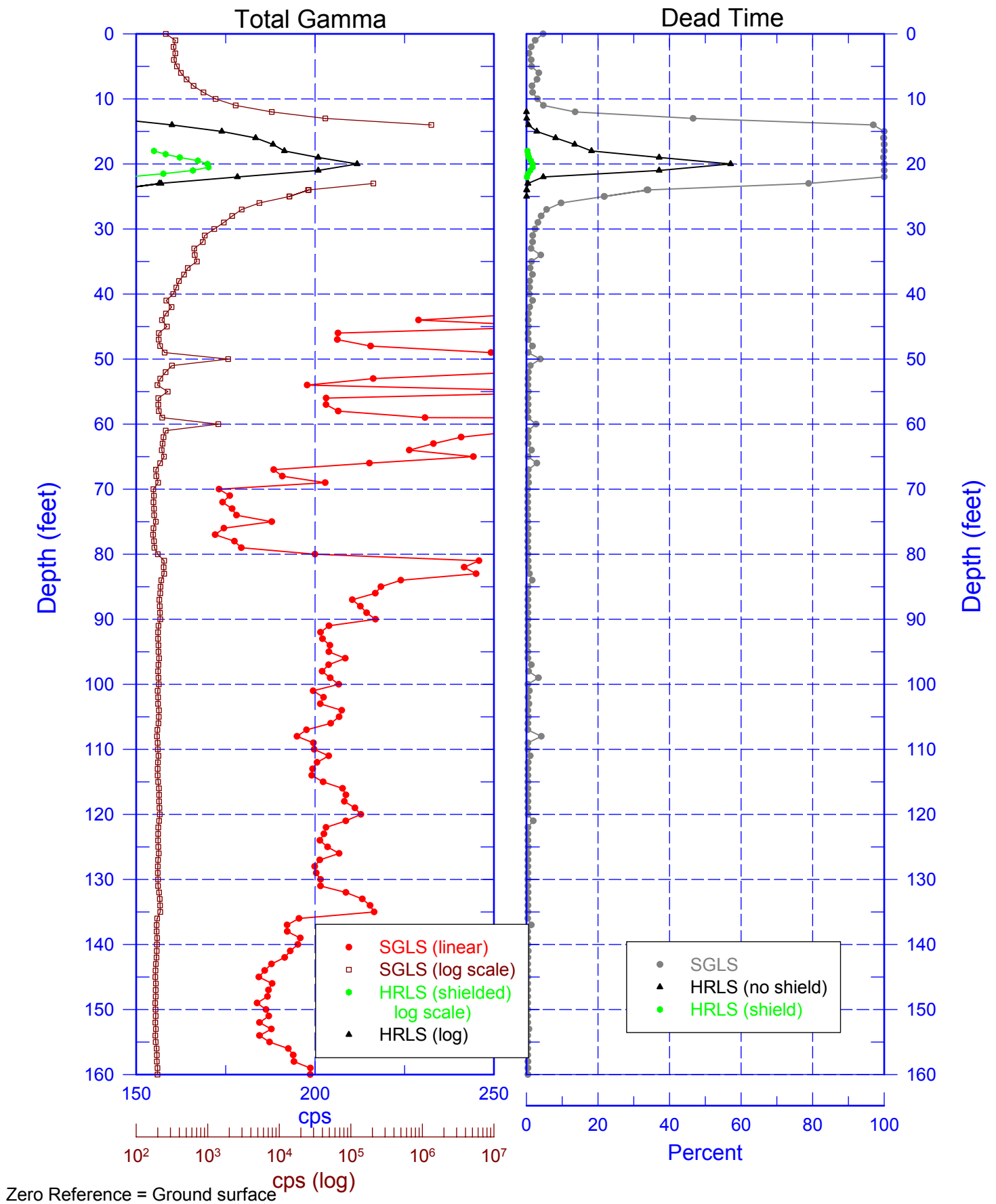


# C4545

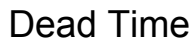


# C4545

## Total Gamma & Dead Time



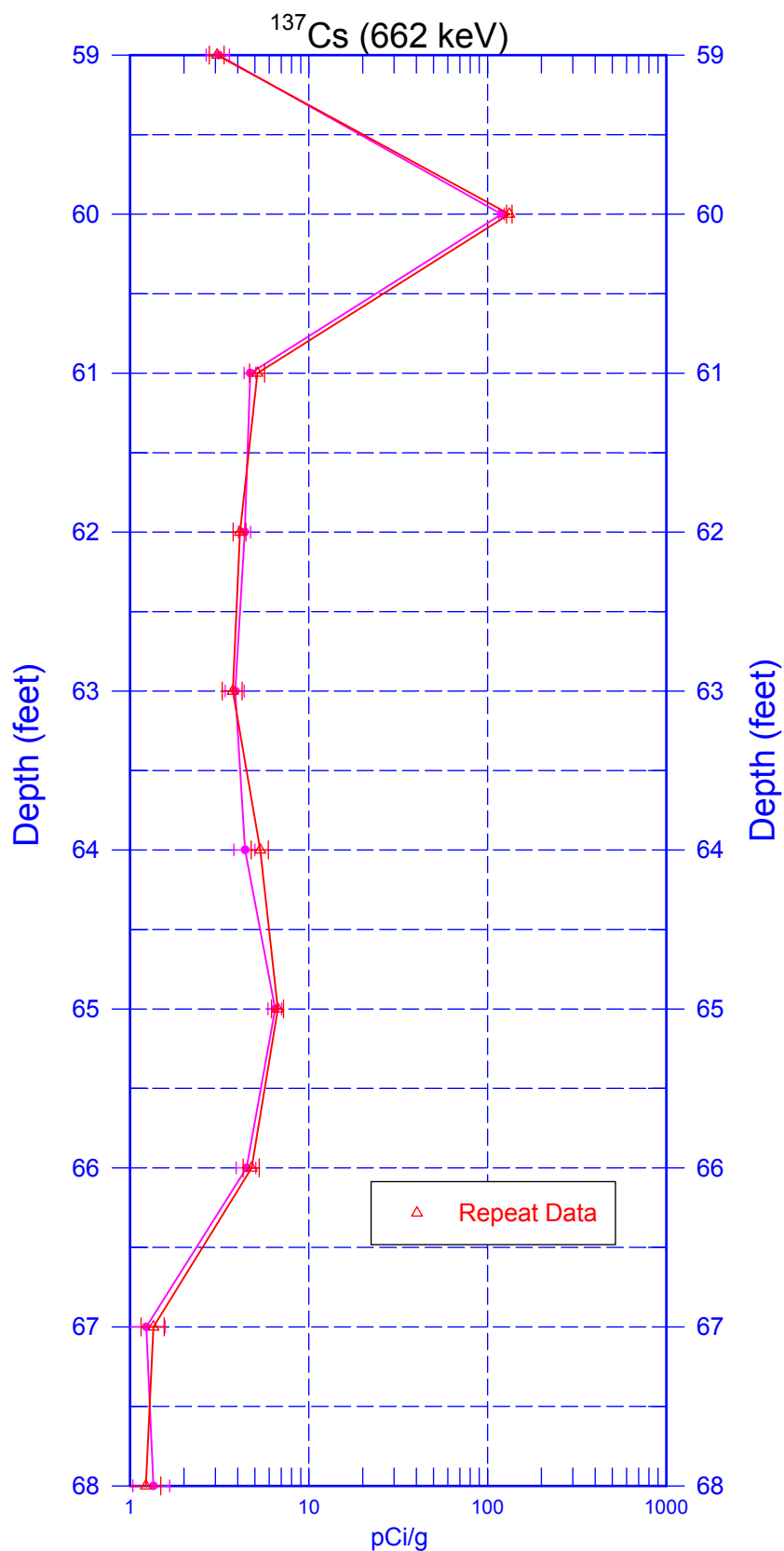
# C4545



Zero Reference = Ground surface

# C4545

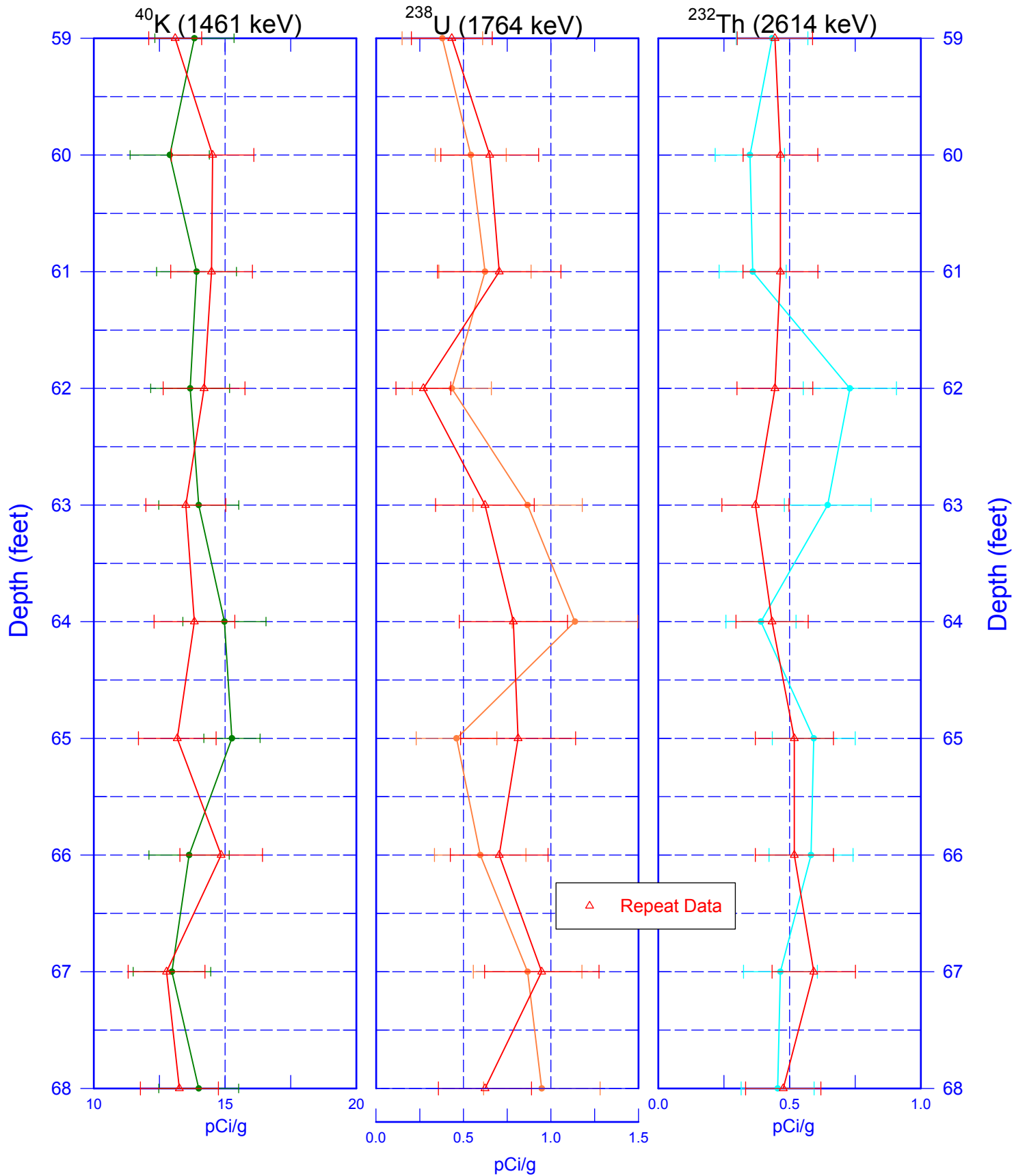
## Repeat Section of Man-Made Radionuclides



Zero Reference = Ground surface

# C4545

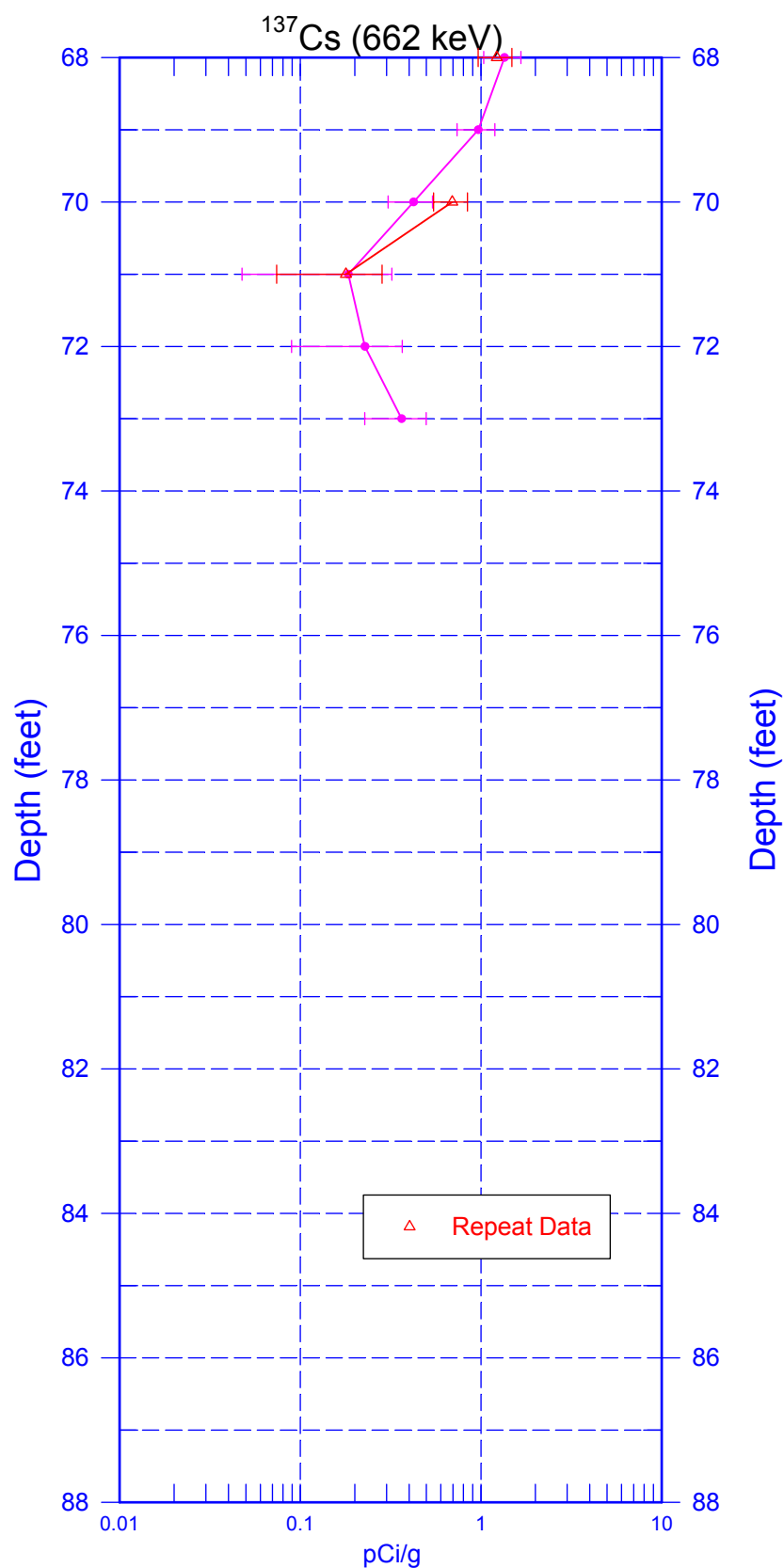
## Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface

# C4545

## Repeat Section of Man-Made Radionuclides

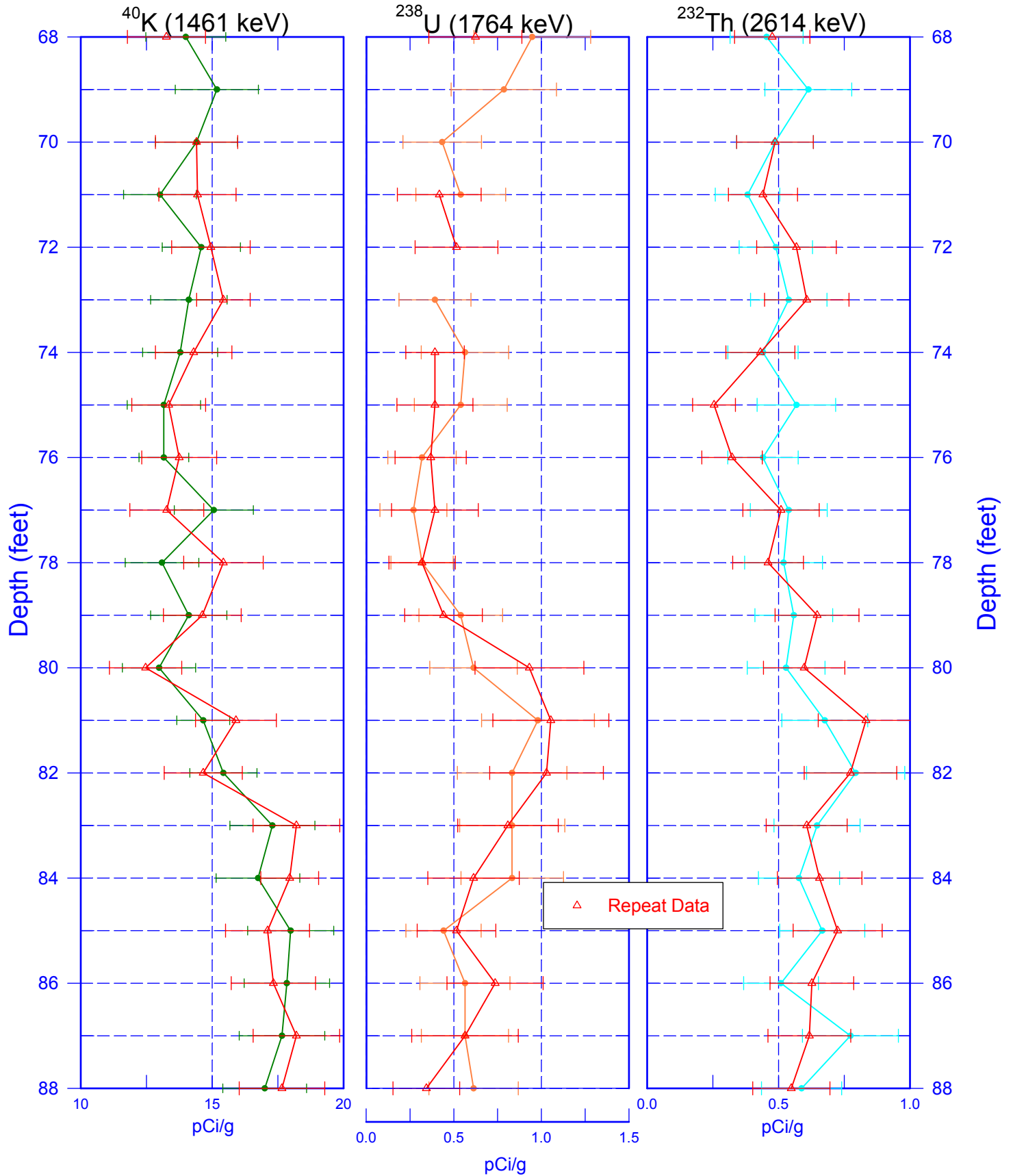


Zero Reference = Ground surface



# C4545

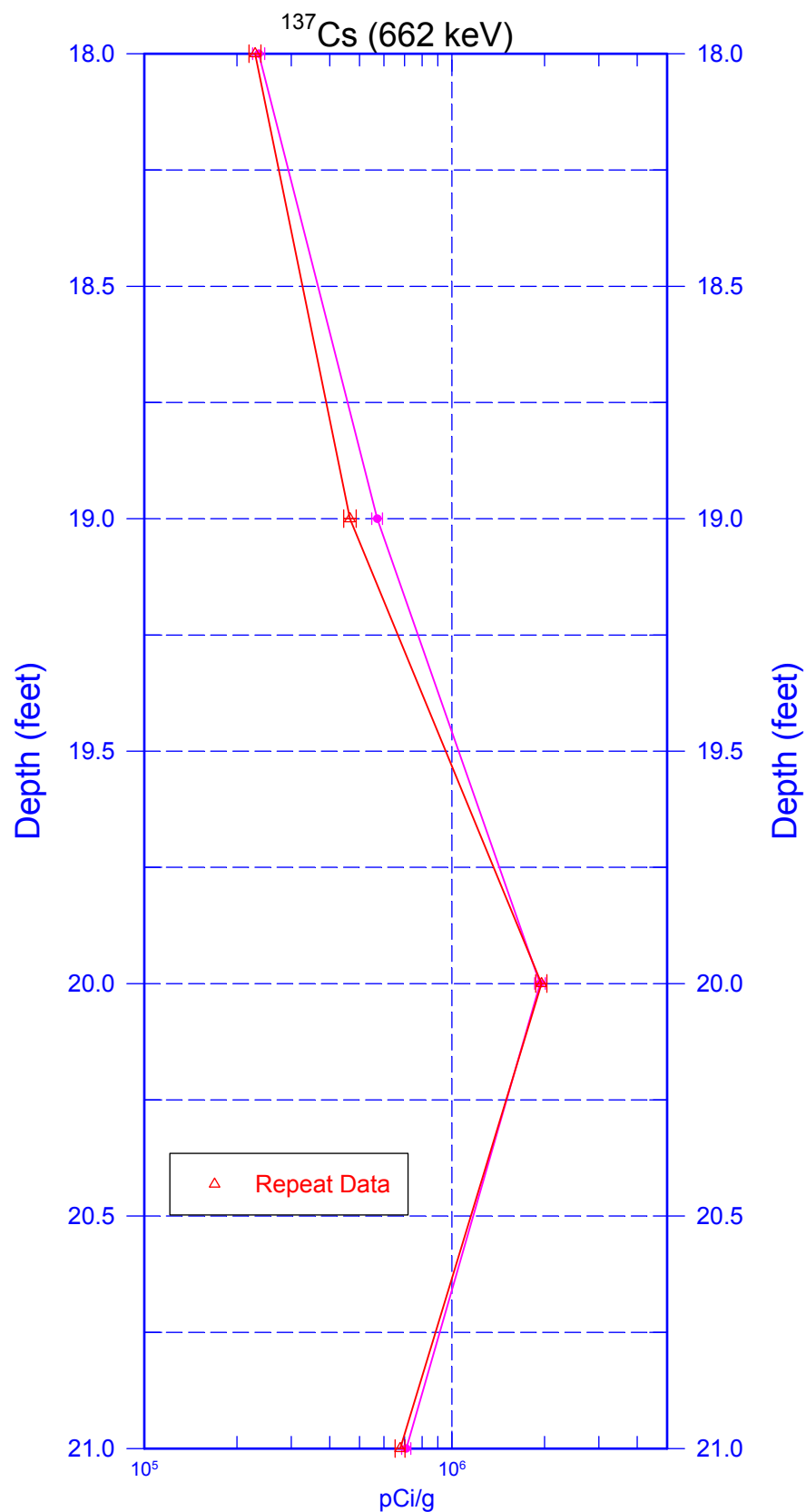
## Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface

# C4545

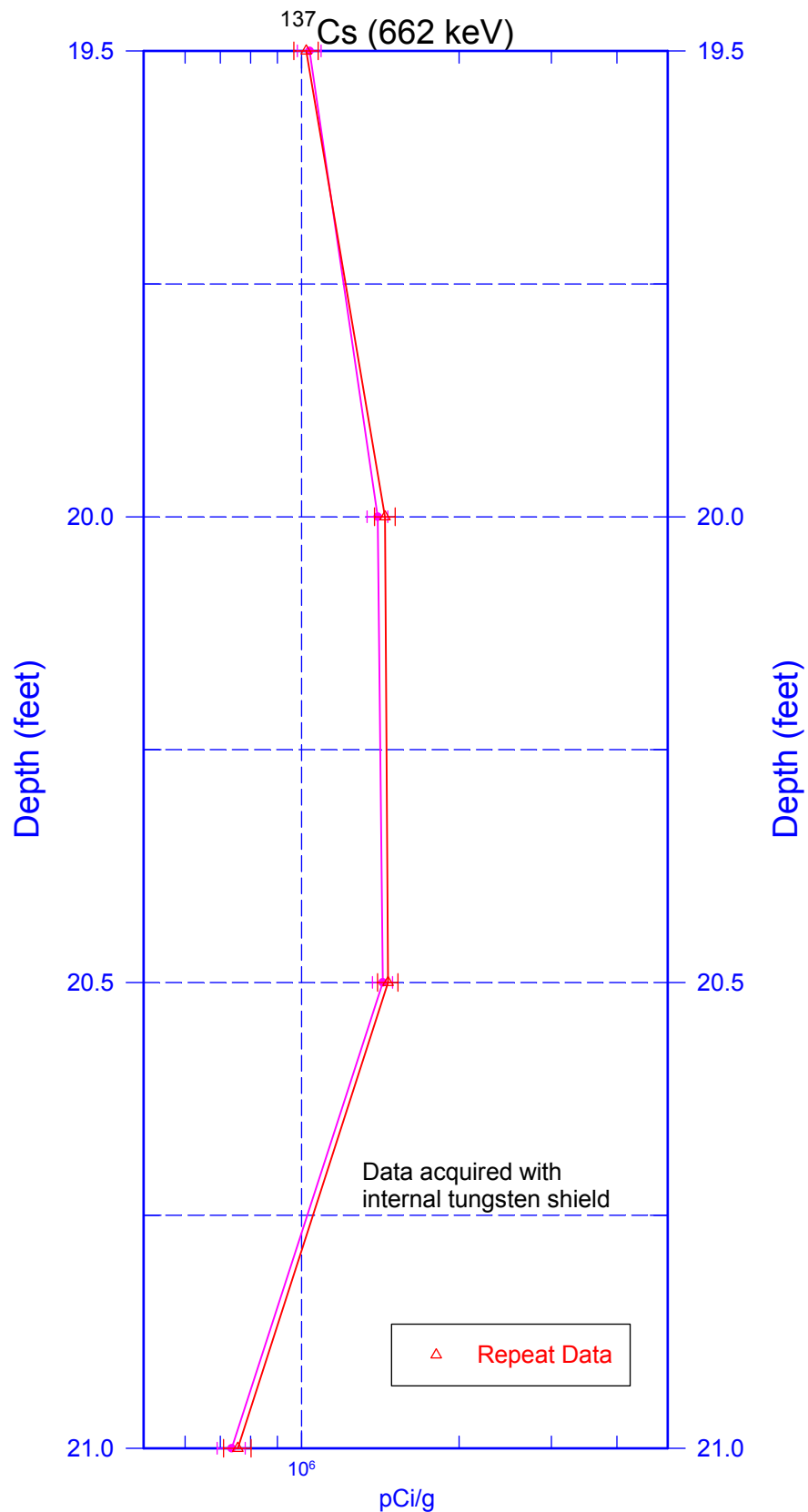
## Repeat Section of High Rate (No Shield)



Zero Reference = Ground surface

# C4545

## Repeat Section of High Rate (Internal Shield)



Zero Reference = Ground surface